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10/597,470	07/26/2006	Fukudome Masato	81863.0056	1625

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EXAMINER	
WON, BUMSUK	

ART UNIT	PAPER NUMBER
2889	

NOTIFICATION DATE	DELIVERY MODE
10/15/2009	ELECTRONIC

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

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Office Action Summary	Application No.	Applicant(s)	
	10/597,470	MASATO ET AL.	
	Examiner	Art Unit	
	BUMSUK WON	2889	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE *3* MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *26 July 2006*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-41* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-41* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☒ None of:

1.☒ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date *7/26/2006, 11/15/2006*.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

Priority

Acknowledgment is made of applicant's claim for foreign priority based on an application filed in Japan on 1/26/2004. It is noted, however, that applicant has not filed a certified copy of the 2004-016699 application as required by 35 U.S.C. 119(b).

Claim Objections

Claims 1-41 are objected to because of the following informalities:

Claims 1-41 does not have "." at the end of each claims. Appropriate correction is required.

Claims 22 and 38 recite "the anterior surface" which should be "an anterior surface". Appropriate correction is required.

Claim 40 recites "the above-mentioned step (a)" which should be "the above-mentioned step of (a) dispersing".

Claim Rejections - 35 USC § 112

The following is a quotation of the second paragraph of 35 U.S.C. 112:

> The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

Claims 1- 41 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

Regarding claim 1, the term "as" in front of "phosphors" renders the claim indefinite because it is unclear whether the limitations following the term are part of the

claimed invention. See MPEP § 2173.05(d). Claims 2-21 and 41 are rejected due to claim dependency.

Claims 2 and 23 recites the limitation "a resin matrix" and "a plurality of wavelength conversion layers". There is insufficient antecedent basis for this limitation in the claim. Claim 16 is rejected due to claim dependency.

Claim 17 recites the limitation "a refractive index". It is unclear of which part "a refractive index" is referred to.

Regarding claim 22, the term "as" in front of "phosphors" renders the claim indefinite because it is unclear whether the limitations following the term are part of the claimed invention. See MPEP § 2173.05(d). Claims 23-37 are rejected due to claim dependency.

Regarding claim 38, the term "as" in front of "phosphors" renders the claim indefinite because it is unclear whether the limitations following the term are part of the claimed invention. See MPEP § 2173.05(d).

Claim 39 recites the limitation "the molded product" and "the sheet". There is insufficient antecedent basis for this limitation in the claim. Claims 40 and 41 are rejected due to claim dependency.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

Claims 1-5, 10, 16-27, 31-36, 38, 39 and 41 are rejected under 35 U.S.C. 103(a) as being unpatentable over Cho (US 2004/0217692) in view of Maeda (US 2004/0104391).

Regarding claim 1, Cho discloses a wavelength converter (figures 5A and 5B), comprising a plurality of wavelength conversion layers (120) at least one type of fluorescent substance in a resin matrix (paragraph 39).

Cho does not specifically disclose the conversion layers includes at least one type of semiconductor ultrafine particles having a mean particle size of not more than 20 nm and the at least one type of fluorescent substance having a mean particle size of not less than 0.1 micron.

Maeda discloses a wavelength converter (figure 2, 3), comprising a wavelength conversion layer (3) containing at least one type of semiconductor ultrafine particles (paragraph 101) having a mean particle size of not more than 20 nm (paragraph 101) and at least one type of fluorescent substance (2) having a mean particle size of not less than 0.1 micron (paragraph 40) in a resin matrix (13), for the purpose of preventing the sedimentation of the fluorescent substances (paragraph 101).

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to have at least one type of semiconductor ultrafine particles having a mean particle size of not more than 20 nm and the at least one type of fluorescent substance having a mean particle size of not less than 0.1 micron as disclosed by Maeda in the device disclosed by Cho, for the purpose of preventing the sedimentation of the fluorescent substances.

Regarding claim 2, Maeda discloses the semiconductor ultrafine particles (paragraph 101) and the fluorescent substance (2) are dispersed in a resin matrix (13). Cho in view of Maeda does not specifically disclose the layers are unevenly distributed in the form of layers and form the plurality of wavelength conversion layers. However, it would have been obvious to one of ordinary skill in the art at the time the invention was made to have the layers are unevenly distributed in the form of layers and form the plurality of wavelength conversion layers in the device disclosed by Cho in view of Maeda due to the relatively large particle sizes of the fluorescent substances compared to the thickness of the layers. The reason for combining is same as claim 1.

Regarding claim 3, Maeda discloses each of the semiconductor ultrafine particles is a semiconductor composition consisting of at least two or more elements that belong to the groups I-b, II, III, IV, V and VI of the periodic table (paragraph 174). The reason for combining is same as claim 1.

Regarding claim 4, Cho in view of Maeda does not specifically disclose the band gap energy of the semiconductor ultrafine particles is 1.5 to 2.5 eV. However, one of ordinary skill in the art would have been led to the recited ranges through routine experimentation and optimization. Applicant has not disclosed that the ranges are for a particular unobvious purpose, produce an unexpected result, or are otherwise critical, and it appears prima facie that the process would possess utility using another ranges. Indeed, it has been held that mere ranges limitations are prima facie obvious absent a disclosure that the limitations are for a particular unobvious purpose, produce an unexpected result, or are otherwise critical.

Regarding claim 5, Cho discloses the resin matrix is a substantially single resin layer (paragraph 39).

Regarding claim 10, Maeda discloses the semiconductor ultrafine particles have a mean particle size of 0.5 to 20 nm (paragraph 101).

Regarding claim 16, The examiner notes that the claim limitation of the resin matrix being obtained by hardening a liquid unhardened material of a mixture of the semiconductor ultrafine particles and the fluorescent substance is drawn to a process of manufacturing which is incidental to the claimed apparatus. It is well established that a claimed apparatus cannot be distinguished over the prior art by a process limitation. Consequently, absent a showing of an unobvious difference between the claimed product and the prior art, the subject product-by-process claim limitation is not afforded patentable weight (MPEP 2113).

Regarding 17, Cho in view of Maeda does not specifically disclose a refractive index of the resin matrix is not less than 1.7. However, it is widely known in the art to reduce the refractive index of the resin matrix thereby enhancing light emissivity.

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to have a refractive index of the resin matrix is not less than 1.7 in the device disclosed by Cho in view of Maeda, for the purpose of enhancing light emissivity.

Also, one of ordinary skill in the art would have been led to the recited ranges through routine experimentation and optimization. Applicant has not disclosed that the ranges are for a particular unobvious purpose, produce an unexpected result, or are

otherwise critical, and it appears prima facie that the process would possess utility using another ranges. Indeed, it has been held that mere ranges limitations are prima facie obvious absent a disclosure that the limitations are for a particular unobvious purpose, produce an unexpected result, or are otherwise critical.

Regarding claims 18 and 19, the examiner notes that the claim limitation of the resin matrix being hardened by heat energy or light energy is drawn to a process of manufacturing which is incidental to the claimed apparatus. It is well established that a claimed apparatus cannot be distinguished over the prior art by a process limitation. Consequently, absent a showing of an unobvious difference between the claimed product and the prior art, the subject product-by-process claim limitation is not afforded patentable weight (MPEP 2113).

Regarding claim 20, Cho in view of Maeda does not specifically disclose the resin matrix comprises polymer resin containing silicon-oxygen bonds in a main chain.

However, it is widely known in the art to use polymer resin containing silicon-oxygen bonds in a main chain for resin matrix due to its availability.

Also, one of ordinary skill in the art would have been led to form the resin matrix containing silicon-oxygen bonds in a main chain as a matter of choice. Applicant has not disclosed that the configuration is for a particular unobvious purpose, produce an unexpected/significant result, or are otherwise critical, and it appears prima facie that the process would possess utility using another configuration.

Regarding claim 21, Cho discloses the wavelength converter generates fluorescence having at least two or more intensity peaks in the range of wavelengths of visible light (R, G, B).

Regarding claim 22, Cho discloses a light-emitting device (figures 5A and 5B) comprising a light-emitting element (110) that is provided on a substrate (105) and emits excitation light, and a wavelength converter (120) that is positioned on an anterior surface of the light-emitting element and converts the excitation light into visible light wherein the visible light is output light ("white light"), wherein the wavelength converter (figures 5A and 5B), comprising a plurality of wavelength conversion layers (120) at least one type of fluorescent substance in a resin matrix (paragraph 39).

Cho does not specifically disclose the conversion layers includes at least one type of semiconductor ultrafine particles having a mean particle size of not more than 20 nm and the at least one type of fluorescent substance having a mean particle size of not less than 0.1 micron.

Maeda discloses a light emitting device (figure 2) including a wavelength converter (figure 2, 3), comprising a wavelength conversion layer (3) containing at least one type of semiconductor ultrafine particles (paragraph 101) having a mean particle size of not more than 20 nm (paragraph 101) and at least one type of fluorescent substance (2) having a mean particle size of not less than 0.1 micron (paragraph 40) in a resin matrix (13), for the purpose of preventing the sedimentation of the fluorescent substances (paragraph 101).

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to have at least one type of semiconductor ultrafine particles having a mean particle size of not more than 20 nm and the at least one type of fluorescent substance having a mean particle size of not less than 0.1 micron as disclosed by Maeda in the device disclosed by Cho, for the purpose of preventing the sedimentation of the fluorescent substances.

Regarding claim 23, Maeda discloses the semiconductor ultrafine particles (paragraph 101) and the fluorescent substance (2) are dispersed in a resin matrix (13). Cho in view of Maeda does not specifically disclose the layers are unevenly distributed in the form of layers and form the plurality of wavelength conversion layers. However, it would have been obvious to one of ordinary skill in the art at the time the invention was made to have the layers are unevenly distributed in the form of layers and form the plurality of wavelength conversion layers in the device disclosed by Cho in view of Maeda due to the relatively large particle sizes of the fluorescent substances compared to the thickness of the layers. The reason for combining is same as claim 22.

Regarding claim 24, Cho discloses the plurality of wavelength conversion layers are disposed so that peak wavelengths of light converted in each wavelength conversion layer can be progressively shorter from the light-emitting element side toward the outside (figures 5A and 5B, R, G, B).

Regarding claim 25, Cho in view of Maeda does not specifically disclose at least part of band gap energy of the phosphors is smaller than energy generated by the light-emitting element.

However, it would have been obvious to one of ordinary skill in the art at the time the invention was made to have at least part of band gap energy of the phosphors is smaller than energy generated by the light-emitting element in the device disclosed by Cho in view of Maeda, for the purpose of enhancing efficiency of the device.

Regarding claim 26, Cho discloses the wavelength converter (120) comprises at least three wavelength conversion layers and each light converted in the three wavelength conversion layers has a wavelength respectively corresponding to red, green and blue (figures 5A and 5B).

Regarding claim 27, Cho discloses each of the wavelength conversion layers is composed of a polymer resin thin film containing the phosphors (paragraph 33).

Regarding claim 31, Cho discloses the peak wavelength of output light from the fluorescent substance is 400 to 700 nm (figures 5A and 5B, the fluorescent substance emits R, G, B).

Regarding claim 32, Cho discloses the excitation light has a center wavelength of not more than 450 nm (paragraph 4).

Regarding claim 33, Cho discloses the output light has a peak wavelength of 400 to 900 nm (figures 5A and 5B, the fluorescent substance emits R, G, B and outputs white light).

Regarding claim 34, Cho discloses the resin matrix is a substantially single resin layer (paragraph 39).

Regarding claims 35 and 36, Cho in view of Maeda does not specifically disclose the thickness dimension of the conversion layers. However, one of ordinary skill in the

art would have been led to the recited dimensions through routine experimentation and optimization. Applicant has not disclosed that the dimensions are for a particular unobvious purpose, produce an unexpected result, or are otherwise critical, and it appears prima facie that the process would possess utility using another dimension. Indeed, it has been held that mere dimensional limitations are prima facie obvious absent a disclosure that the limitations are for a particular unobvious purpose, produce an unexpected result, or are otherwise critical.

Regarding claim 38, Cho discloses a light-emitting device (figures 5A and 5B) comprising a light-emitting element (110) that is provided on a substrate (105) and emits excitation light, and a wavelength converter that is positioned on an anterior surface of the light-emitting element and converts the excitation light into visible light (white light) wherein the visible light is output light, wherein the wavelength converter (figures 5A and 5B), comprising a plurality of wavelength conversion layers (120) at least one type of fluorescent substance in a polymer resin thin film (paragraph 39).

Cho does not specifically disclose the conversion layers includes at least one type of semiconductor ultrafine particles having a mean particle size of not more than 20 nm and the at least one type of fluorescent substance having a mean particle size of not less than 0.1 micron.

Maeda discloses a light emitting device (figure 2) including a wavelength converter (figure 2, 3), comprising a wavelength conversion layer (3) containing at least one type of semiconductor ultrafine particles (paragraph 101) having a mean particle size of not more than 20 nm (paragraph 101) and at least one type of fluorescent

substance (2) having a mean particle size of not less than 0.1 micron (paragraph 40) in a resin matrix (13), for the purpose of preventing the sedimentation of the fluorescent substances (paragraph 101).

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to have at least one type of semiconductor ultrafine particles having a mean particle size of not more than 20 nm and the at least one type of fluorescent substance having a mean particle size of not less than 0.1 micron as disclosed by Maeda in the device disclosed by Cho, for the purpose of preventing the sedimentation of the fluorescent substances.

Regarding claim 39, Cho discloses a method of producing a wavelength converter (figures 5A and 5B, 120) comprises the steps of: (a) dispersing at least one type of fluorescent substance (paragraph 39) in an unhardened material of resin (paragraph 39); and (b) molding into sheet-like shape the resin (120, paragraph 39) having the fluorescent substance dispersed.

Cho does not specifically disclose dispersing at least one type of semiconductor ultrafine particles having a mean particle size of not more than 20 nm and at least one type of fluorescent substance having a mean particle size of not less than 0.1 microns in an unhardened material of resin, and dispersing the semiconductor ultrafine particles more on one principal surface side of the molded product, and the fluorescent substance more on the other principal surface side, and hardening the sheet after the semiconductor ultrafine particles and particles of the fluorescent substance are dispersed.

Maeda discloses a method of producing a wavelength converter (figure 2, 3), containing at least one type of semiconductor ultrafine particles (paragraph 101) having a mean particle size of not more than 20 nm (paragraph 101) and at least one type of fluorescent substance (2) having a mean particle size of not less than 0.1 micron (paragraph 40) in a resin matrix (13), for the purpose of preventing the sedimentation of the fluorescent substances (paragraph 101).

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to have at least one type of semiconductor ultrafine particles having a mean particle size of not more than 20 nm and the at least one type of fluorescent substance having a mean particle size of not less than 0.1 micron as disclosed by Maeda in the device disclosed by Cho, for the purpose of preventing the sedimentation of the fluorescent substances.

Cho in view of Maeda does not specifically disclose the particles and substance are dispersed in an unhardened material of resin and the material of resin is hardened after the particles and substance are dispersed; and dispersing the semiconductor ultrafine particles more on one principal surface side of the molded product, and the fluorescent substance more on the other principal surface side.

However, it would have been obvious to one of ordinary skill in the art at the time the invention was made to have the particles and substance are dispersed in an unhardened material of resin and the material of resin is hardened after the particles and substance are dispersed in the method disclosed by Cho in view of Maeda, for the purpose of effectively dispersing the particles and substance in the resin, and to have

the semiconductor ultrafine particles more on one principal surface side of the molded product, and the fluorescent substance more on the other principal surface side in the method disclosed by Cho in view of Maeda due to the gravity difference between the relatively smaller particles and relatively larger substances.

Regarding claim 41, Cho discloses a method of producing a light-emitting device (figures 5A and 5B) comprising the steps of: providing a light-emitting element (110) on a substrate (105); and disposing the wavelength converter (120) according to claim 1 (note claim 1 rejection above) so as to cover the light-emitting element (110).

Claims 6, 11, 15, 28-30 and 37 are rejected under 35 U.S.C. 103(a) as being unpatentable over Cho (US 2004/0217692) in view of Maeda (US 2004/0104391), in further view of Thurk (US 2004/0245912).

Regarding claim 6, Cho in view of Maeda does not specifically disclose the surface of the particles is coated with surface modifying molecules.

Thurk discloses wavelength converter (figure 7, 78) having the semiconductor ultrafine particles have surfaces coated with surface modifying molecules (paragraph 32, the examiner interprets particles as cores and surface modifying molecules as shells), for the purpose of protecting the particles inside the shell thereby enhancing the efficiency of light emission.

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to have the surface of the particles is coated with surface modifying molecules as disclosed by Thurk in the device disclosed by Cho in view of

Maeda, for the purpose of protecting the particles inside the shell thereby enhancing the efficiency of light emission.

Regarding claim 11, Cho in view of Maeda does not specifically disclose the semiconductor ultrafine particles have core-shell structure.

Thurk discloses a wavelength converter (figure 7, 78) having the semiconductor ultrafine particles have core-shell structure (paragraph 32), for the purpose of enhancing efficiency of light emission.

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to have the semiconductor ultrafine particles have core-shell structure as disclosed by Thurk in the device disclosed by Cho in view of Maeda, for the purpose of enhancing efficiency of light emission.

Regarding claim 15, Thurk discloses the semiconductor ultrafine particles have light luminescence capability (paragraph 32). The reason for combining is same as claim 11.

Regarding claim 28, Thurk discloses phosphors contained in the wavelength converter are semiconductor ultrafine particles having a mean particle size of not more than 10 nm (paragraph 32).

Regarding claim 29, Cho in view of Maeda and Thurk does not specifically disclose the wavelength conversion layers containing the semiconductor ultrafine particles are disposed on the light-emitting element side and a peak wavelength of output light from the semiconductor ultrafine particles is larger than a peak wavelength of output light from the fluorescent substance.

However, Thurk discloses different particle sizes converts lights into different wavelengths (paragraph 33).

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to have the wavelength conversion layers containing the semiconductor ultrafine particles are disposed on the light-emitting element side and a peak wavelength of output light from the semiconductor ultrafine particles is larger than a peak wavelength of output light from the fluorescent substance in the device disclosed by Cho in view of Maeda and Thurk, for the purpose of controlling the output light wavelength by controlling the size of the particles.

Regarding claim 30, Thurk discloses the peak wavelength of output light from the semiconductor ultrafine particles is 500 to 900 nm (paragraph 33). The reason for combining is same as claim 29.

Regarding claim 37, Thurk discloses the phosphors contained in the plurality of wavelength conversion layers are composed of approximately the same material and are respectively semiconductor ultrafine particles having different mean particle sizes (paragraph 33). The reason for combining is same as claim 29.

Claims 7-9 are rejected under 35 U.S.C. 103(a) as being unpatentable over Cho in view of Maeda and Thurk, in further view of Tanaka (US 2004/0067849).

Regarding claim 7, Cho in view of Maeda and Thurk does not specifically disclose the surface modifying molecules have two or more silicon oxygen bonds repeated.

Tanaka discloses a light emitting device (paragraph 3) including bonding ultrafine particles with silicon oxygen bonds (paragraph 132), for the purpose of increasing bonds between the ultrafine particles thereby dispersing the particles in homogenous manner.

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to have bonding ultrafine particles with silicon oxygen bonds as disclosed by Tanaka in the device disclosed by Cho in view of Maeda and Thurk, for the purpose of increasing bonds between the ultrafine particles thereby dispersing the particles in homogenous manner.

Regarding claim 8, Tanaka discloses the surface modifying molecules form coordinate bonds to the surface of the particles (paragraph 132). The reason for combining is same as claim 7.

Regarding claim 9, Cho in view of Maeda, Thurk and Tanaka does not specifically disclose the number of silicon-oxygen repeating units of each of the surface modifying molecules is 5 to 500.

However, one of ordinary skill in the art would have been led to the recited ranges through routine experimentation and optimization. Applicant has not disclosed that the ranges are for a particular unobvious purpose, produce an unexpected result, or are otherwise critical, and it appears prima facie that the process would possess utility using another ranges. Indeed, it has been held that mere ranges limitations are prima facie obvious absent a disclosure that the limitations are for a particular unobvious purpose, produce an unexpected result, or are otherwise critical.

Claims 12-14 are rejected under 35 U.S.C. 103(a) as being unpatentable over Cho in view of Maeda and Thurk, in further view of Manabu (JP 2002-121548) which is cited in the IDS.

Regarding claim 12, Cho in view of Maeda and Thurk does not specifically disclose each of the surface-modifying molecules has at least one functional group selected from the group consisting of an amino group, a mercapto group, a carboxyl group, an amide group, an ester group, a carbonyl group, a phosphoxide group, a sulfoxide group, a phosphone group, an imine group, a vinyl group, a hydroxy group and an ether group.

Manabu discloses a wavelength converter (paragraph 1) including the surface-modifying molecules has at least one functional group selected from the group consisting of an amino group, a mercapto group, a carboxyl group, an amide group, an ester group, a carbonyl group, a phosphoxide group, a sulfoxide group, a phosphone group, an imine group, a vinyl group, a hydroxy group and an ether group (paragraph 19), for the purpose of enhancing mechanical strength and chemical stability of the particles.

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to have the surface-modifying molecules has at least one functional group selected from the group consisting of an amino group, a mercapto group, a carboxyl group, an amide group, an ester group, a carbonyl group, a phosphoxide group, a sulfoxide group, a phosphone group, an imine group, a vinyl group, a hydroxy group and an ether group as disclosed by Manabu in the device

disclosed by Cho in view of Maeda and Thurk, for the purpose of enhancing mechanical strength and chemical stability of the particles.

Regarding claim 13, Manabu discloses each of the surface-modifying molecules is provided with two or more side chains having the functional group (paragraph 19). The reason for combining is same as claim 12.

Regarding claim 14, Manabu discloses a side chain is at least one selected from the group consisting of a methyl group, an ethyl group, a n-propyl group, an iso-propyl group, a n-butyl group, an iso-butyl group, a n-pentyl group, an iso-pentyl group, a n-hexyl group, an iso-hexyl group, a cyclohexyl group, a methoxy group, an ethoxy group, a n-propoxy group, an iso-propoxy group, a n-butoxy group, an iso-butoxy group, a n-pentoxy group, an iso-pentoxy group, a n-hexyloxy group, an iso-hexyloxy group and a cyclohexyloxy group (paragraph 19). The reason for combining is same as claim 12.

Claim 40 is rejected under 35 U.S.C. 103(a) as being unpatentable over Cho in view of Maeda, in further view of Manabu.

Regarding claim 40, Cho in view of Maeda does not specifically disclose the step of synthesizing semiconductor ultrafine particles in a liquid phase and allowing silicone-based compounds in the liquid phase to coordinate, each of which is mainly composed of silicon-oxygen bonds and has a functional group selected from the group consisting of an amino group, a carboxyl group, a mercapto group and a hydroxy group, prior to the above-mentioned step (a) dispersing.

Manabu discloses a method of producing a wavelength converter (paragraph 1) including the step of synthesizing semiconductor ultrafine particles in a liquid phase

(paragraph 31) and allowing silicone-based compounds in the liquid phase to coordinate (paragraph 14), each of which is mainly composed of silicon-oxygen bonds and has a functional group selected from the group consisting of an amino group, a carboxyl group, a mercapto group and a hydroxy group (paragraph 19), prior to the above-mentioned step (a) dispersing (paragraph 19), for the purpose of enhancing mechanical strength and chemical stability of the particles.

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to have the step of synthesizing semiconductor ultrafine particles in a liquid phase and allowing silicone-based compounds in the liquid phase to coordinate, each of which is mainly composed of silicon-oxygen bonds and has a functional group selected from the group consisting of an amino group, a carboxyl group, a mercapto group and a hydroxy group, prior to the above-mentioned step (a) dispersing as disclosed by Manabu in the method disclosed by Cho in view of Maeda, for the purpose of enhancing mechanical strength and chemical stability of the particles.

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to BUMSUK WON whose telephone number is (571)272-2713. The examiner can normally be reached on Monday through Friday, 8:00 am to 5:00 pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Minh Toan Ton can be reached on 571-272-2303. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/Bumsuk Won/
Primary Examiner, Art Unit 2889